Лабораторная работа №2 по теме: «Преобразование в стандартные формы: ДНФ и СДНФ, КНФ и СКНФ».

Вариант 14.

Цель работы:

1. Научиться находить ДНФ, КНФ, СДНФ и СКНФ;
2. Научиться находить МДНФ и МКНФ различными способами;
3. Строить многочлен Жегалкина.

Оборудование:

Excel, Word, ПК.

ХОД РАБОТЫ

1. Нахождение ДНФ и КНФ для функции:

F(x,y,z) = (x ⊕ y) → (x ⊕ z)

(x̅\*y v x\*y̅) -> (x̅\*z v x\*z̅)

¬(¬x\*y v x\* y̅) v (x̅\*z v x\* z̅)

(¬(x̅\*y) \* ¬(x\*y̅)) v (x̅\*z v x\* z̅)

((x v y̅) \* (x̅ v y)) v (x̅\*z v x\* z̅)

((x\* (x̅ v y)) v (y̅ \* (¬x v y))) v (x̅\*z v x\* z̅)

(xy v xy̅) v (x̅\*z v x\* z̅)

x(y v y̅) v (x̅\*z v x\* z̅)

x v x̅z v xz̅

ДНФ: x v x̅^z v x^z̅

x v x̅z v xz̅

(x v x̅)\*(x v z) v xz̅

x v z v x¬z

x v (z v x)\*(z v z̅)

КНФ: x v z

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **x** | **y** | **z** | **x⊕y** | **x⊕z** | **(x⊕y) -> (x⊕z)** | **ДНФ** |
| 0 | 0 | 0 | 0 | 0 | 1 | x v ¬x^z v x^¬z |
| 0 | 0 | 1 | 0 | 1 | 1 | **КНФ** |
| 0 | 1 | 0 | 1 | 0 | 0 | x v z |
| 0 | 1 | 1 | 1 | 1 | 1 |  |
| 1 | 0 | 0 | 1 | 1 | 1 |  |
| 1 | 0 | 1 | 1 | 0 | 0 |  |
| 1 | 1 | 0 | 0 | 1 | 1 |  |
| 1 | 1 | 1 | 0 | 0 | 1 |  |
| **CДНФ** | | | | | | |
| (¬x¬y¬z) v (¬x¬yz) v (¬xyz) v (x¬y¬z) v (xy¬z) v (xyz) | | | | | | |
| **CКНФ** | | | | | | |
| (¬x v y v ¬z) ^ (x^ ¬y ^ z) | | | | | | |

1. Нахождение СДНФ и СКФН для функции. Построение МДНФ методом Квайна.

|  |  |  |  |
| --- | --- | --- | --- |
| **x** | **y** | **z** | **f** |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

|  |  |
| --- | --- |
| СДНФ | (¬X¬YZ) v (¬XYZ) v (XY¬Z) v (XYZ) |
| СКНФ | (XvYvZ) ^ (Xv¬YvZ) ^ (¬XvYvZ) ^ (¬XvYv¬Z) |
| МДНФ | (¬XYZ) v ¬(XYZ) |

1. Построение таблицы истинности для функции F(x,y,z)=

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **x** | **y** | **z** | **¬y** | **¬z** | **¬y v z** | **x v ¬z** | **¬1&2** |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |

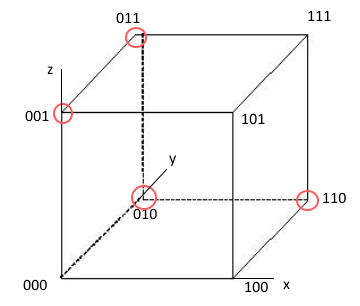
* 1. Двоичная форма F булевой функции.

|  |
| --- |
| **Двоичная форма F булевой функции** |
| 1110010 |

* 1. Приведение функции к СДНФ и СКНФ.

|  |
| --- |
| **СДНФ** |
| (¬X¬YZ) v (¬XY¬Z) v (¬XYZ) v (XY¬Z) |
| **СКНФ** |
| (¬X v ¬Y v ¬Z) ^ (X v ¬Y v ¬Z) ^ (X v ¬Y v Z) ^ (XYZ) |

* 1. Изображение функции графически.



1. Составление полинома Жегалкина методом неопределенных коэффициентов и с помощью треугольника Паскаля для функции f(010,100,101,111)=0.

Методом неопределенных функций:

f(0,0,0) = a0 = 1

f(0,0,1) = a3⊕a0 = 1

f(0,1,0) = a2⊕a0 = 0

f(0,1,1) = a23⊕a2⊕a3⊕a0 = 1

f(1,0,0) = a1⊕a0 = 0

f(1,0,1) = a13⊕a1⊕a3⊕a0 = 0

f(1,1,0) = a12⊕a1⊕a2⊕a0 = 1

f(1,1,1) = a123⊕a23⊕a13⊕a12⊕a1⊕a2⊕a3⊕a0 = 0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **x** | **y** | **z** | **f** | **a** | **a =** | **Полином Жегалкина** |
| 0 | 0 | 0 | 1 | a0 | 1 | 1 ⊕ y ⊕ yz ⊕ x |
| 0 | 0 | 1 | 1 | a3 | 0 |
| 0 | 1 | 0 | 0 | a2 | 1 |
| 0 | 1 | 1 | 1 | a23 | 1 |
| 1 | 0 | 0 | 0 | a1 | 1 |
| 1 | 0 | 1 | 0 | a13 | 0 |
| 1 | 1 | 0 | 1 | a12 | 0 |
| 1 | 1 | 1 | 0 | a123 | 0 |

С помощью треугольника Паскаля:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Треугольник Паскаля** | | | | | | | | | | | | | | |
| 1 |  | 1 |  | 0 |  | 1 |  | 0 |  | 0 |  | 1 |  | 0 |
|  | 0 |  | 1 |  | 1 |  | 1 |  | 0 |  | 1 |  | 1 |  |
|  |  | 1 |  | 0 |  | 0 |  | 1 |  | 1 |  | 0 |  |  |
|  |  |  | 1 |  | 0 |  | 1 |  | 0 |  | 1 |  |  |  |
|  |  |  |  | 1 |  | 1 |  | 1 |  | 1 |  |  |  |  |
|  |  |  |  |  | 0 |  | 0 |  | 0 |  |  |  |  |  |
|  |  |  |  |  |  | 0 |  | 0 |  |  |  |  |  |  |
|  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |

Ответ: 1 ⊕ y ⊕ yz ⊕ x

1. Составление полинома Жегалкина двумя способами.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **x** | **y** | **z** | **¬x** | **¬y** | **x v ¬y** | **z⊕¬x** | **¬(1 -> 2)** |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |

Методом неопределенных функций:

f(0,0,0) = a0 = 1

f(0,0,1) = a3⊕a0 = 0

f(0,1,0) = a2⊕a0 = 1

f(0,1,1) = a23⊕a2⊕a3⊕a0 = 1

f(1,0,0) = a1⊕a0 = 0

f(1,0,1) = a13⊕a1⊕a3⊕a0 = 1

f(1,1,0) = a12⊕a1⊕a2⊕a0 = 0

f(1,1,1) = a123⊕a23⊕a13⊕a12⊕a1⊕a2⊕a3⊕a0 = 1

|  |  |  |  |
| --- | --- | --- | --- |
| **f** | **a** | **a =** | **Полином Жегалкина** |
| 1 | a0 | 1 | 1 ⊕ z ⊕ yz ⊕ x ⊕ xyz |
| 0 | a3 | 1 |
| 1 | a2 | 0 |
| 1 | a23 | 1 |
| 0 | a1 | 1 |
| 1 | a13 | 0 |
| 0 | a12 | 0 |
| 1 | a123 | 1 |

С помощью треугольника Паскаля:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Треугольник Паскаля** | | | | | | | | | | | | | | |
| 1 |  | 0 |  | 1 |  | 1 |  | 0 |  | 1 |  | 0 |  | 0 |
|  | 1 |  | 1 |  | 0 |  | 1 |  | 1 |  | 1 |  | 0 |  |
|  |  | 0 |  | 1 |  | 1 |  | 0 |  | 0 |  | 1 |  |  |
|  |  |  | 1 |  | 0 |  | 1 |  | 0 |  | 1 |  |  |  |
|  |  |  |  | 1 |  | 1 |  | 1 |  | 1 |  |  |  |  |
|  |  |  |  |  | 0 |  | 0 |  | 0 |  |  |  |  |  |
|  |  |  |  |  |  | 0 |  | 0 |  |  |  |  |  |  |
|  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |

Построили таблицу истинности:

Вывод:

В ходе выполнения лабораторной работы научились: находить ДНФ, КНФ, СДНФ и СКНФ; МДНФ и МКНФ различными способами; строить многочлен Жегалкина.